

CLAIMS

What is claimed is:

- 1           1.       An energy transfer element, comprising:  
2           a magnetic element including an external surface; and  
3           at least a first winding and a second winding wound around the external  
4           surface of the magnetic element without a bobbin such that energy to be received  
5           from a power converter circuit input is to be transferred from the first winding to  
6           the second winding through a magnetic coupling provided by the magnetic  
7           element to a power converter circuit output.
- 1           2.       The energy transfer element of claim 1 wherein the external surface  
2           of the magnetic element includes a substantially curved surface.
- 1           3.       The energy transfer element of claim 2 wherein a portion of the  
2           magnetic element including the external surface is substantially cylindrical.
- 1           4.       The energy transfer element of claim 1 wherein the external surface  
2           of the magnetic element includes substantially planar surfaces.
- 1           5.       The energy transfer element of claim 4 wherein a portion of the  
2           magnetic element including the external surface is substantially polygonal.

1           6.       The energy transfer element of claim 1 wherein the first and second  
2 windings are wound directly around the external surface of the magnetic element  
3 without having to thread the first and second windings through an opening defined  
4 by the magnetic element.

1           7.       The energy transfer element of claim 1 wherein the first winding  
2 comprises magnet wire.

1           8.       The energy transfer element of claim 7 wherein the second winding  
2 comprises triple insulated wire.

1           9.       The energy transfer element of claim 7 wherein the second winding  
2 comprises magnet wire.

1           10.      The energy transfer element of claim 9 further comprising an  
2 insulating material between the first and second windings.

1           11.      The energy transfer element of claim 10 wherein the insulating  
2 material comprises a coating applied by dipping.

1           12.    The energy transfer element of claim 10 wherein the insulating  
2 material comprises a coating applied by spraying.

1           13.    The energy transfer element of claim 10 wherein the insulating  
2 material comprises a sleeve.

1           14.    The energy transfer element of claim 13 wherein the sleeve  
2 comprises heat shrink tubing.

1           15.    The energy transfer element of claim 1 further comprising two  
2 electrically conductive pins mounted to the magnetic element through an  
3 electrically insulating material.

1           16.    The energy transfer element of claim 15 wherein each end of the  
2 first winding is coupled to a respective one of the two electrically conductive pins  
3 mounted to the magnetic element through the electrically insulating material.

1           17.    The energy transfer element of claim 16 wherein both ends of the  
2 second winding are not coupled to electrically conductive pins mounted to the  
3 magnetic element through the electrically insulating material.

1           18.     The energy transfer element of claim 1 further comprising a third  
2 winding wound around the external surface of the magnetic element without a  
3 bobbin such that energy to be received from a power converter circuit input is to  
4 be transferred from the first winding to the third winding.

1           19.     The energy transfer element of claim 1 further comprising at least a  
2 partial exterior coating of a material having a magnetic permeability substantially  
3 greater than free space.

1           20.     A method, comprising:  
2 receiving energy from a power converter circuit input with a first winding  
3 wound around an external surface of a magnetic element without a bobbin;  
4 transferring the energy from the first winding to a second winding wound  
5 around the external surface of the magnetic element without the bobbin through a  
6 magnetic coupling provided by the magnetic element between the first and second  
7 windings; and  
8 coupling the energy from the second winding to a power converter circuit  
9 output.

1           21.     The method of claim 20 further comprising regulating the energy  
2 transferred from the power converter circuit input to the power converter circuit

3 output by switching a connection between the power converter circuit input and  
4 the first winding in response to the power converter circuit output.

1 22. The method of claim 21 wherein switching the connection between  
2 the power converter circuit input and the first winding comprising switching the  
3 connection at a fixed frequency.

1 23. The method of claim 21 wherein switching the connection between  
2 the power converter circuit input and the first winding comprising switching the  
3 connection at a variable frequency.

1 24. The method of claim 21 wherein switching the connection between  
2 the power converter circuit input and the first winding comprising switching the  
3 connection with cycle skipping control.

1 25. The method of claim 21 wherein switching the connection between  
2 the power converter circuit input and the first winding comprising switching the  
3 connection with pulse width modulation.

1 26. The method of claim 20 further comprising:  
2 rectifying an alternating current (AC) source to provide direct current (DC)  
3 source energy; and

4 coupling the DC source energy to be received by the power converter  
5 circuit input.

1 27. The method of claim 20 further comprising transferring the energy  
2 from the first winding to a third winding wound around the external surface of the  
3 magnetic element without the bobbin through the magnetic coupling provided by  
4 a magnetic element between the first and third windings.

1 28. The method of claim 20 further comprising insulating the second  
2 winding from the first winding.

1 29. The method of claim 28 further comprising triple insulating the  
2 second winding to insulate the first winding from the second winding.

1 30. The method of claim 28 further comprising coating the first  
2 winding and the magnetic element with an insulating material to insulate the first  
3 winding from the second winding.

1 31. The method of claim 28 further comprising spraying the first  
2 winding and the magnetic element with an insulating material to insulate the first  
3 winding from the second winding.

1           32.    The method of claim 28 further comprising enclosing the first  
2   winding and the magnetic element in an insulative sleeve to insulate the first  
3   winding from the second winding.

1           33.    The method of claim 32 further comprising heating heat shrink  
2   tubing enclosing the first winding and the magnetic element to insulate the first  
3   winding from the second winding.

1           34.    The method of claim 20 further comprising coupling each end of  
2   the first winding to a respective one of the two electrically conductive pins  
3   mounted to the magnetic element through electrically insulating material without  
4   coupling both ends of the second winding to electrically conductive pins mounted  
5   to the magnetic element through electrically insulating material.

1           35.    The method of claim 20 further comprising coating at least a  
2   portion of an energy transfer element formed with the first and second windings  
3   would around the magnetic element with a material having a magnetic  
4   permeability substantially greater than free space.